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Although it is relatively easy to know when an international emergency is occurring – one can listen to people who are on the spot, or sometimes one just has to watch the news, it is quite difficult to be able to gauge just how bad a situation is. One stark question which can give at least a partial answer is: how many people are dying? For this reason, it has become increasingly common for public health authorities to try to describe the magnitude of a health emergency by determining the mortality rates in a population over a given period of time. Few places where emergencies occur have civil registration systems: no birth certificates, no death certificates, no social security records, etc. To overcome these problems, epidemiologists use mortality surveys – interviews with households – to determine how many deaths have occurred. The number of deaths in a population is compared to the number of deaths that are expected to have occurred during the same period, and the result is reported as “excess deaths”.

In developing countries, according to the United Nations Statistics Division, about 0.3-0.5 deaths occur each day for every 10,000 people. In the mid-late 1980's, in the wake of a series of public health emergencies that had resulted in very high mortality in Cambodia/Thailand, Somalia, Ethiopia, and Sudan, epidemiologists at the Center for Disease Control and Prevention devised a simple rule of thumb: when mortality was doubled or trebled and reached a rate of more than 1 death per 10,000 population per day, a situation should be considered an emergency, and international assistance should be provided.

Determining mortality rates is both a skill and an art. Samples have to be carefully selected so that rates calculated from those interviewed are truly representative of the population to which they are being attributed. Questionnaires need to be carefully devised so that both questions and answers are clearly understood by interviewers and respondents. Data need to be carefully recorded and analyzed, because misclassifying information can give very skewed results. Designing, conducting, analyzing, interpreting, and reporting the results of these surveys is difficult and every step should be carefully discussed and considered.

It is important for those reading and using the results of population-based mortality surveys to consider the circumstances in which they are conducted. Gathering representative data from insecure, conflict-affected areas is tricky business. If one goes

only to the ‘safer’ areas, mortality rates (and other important information) will clearly be under-estimated. If surveyors go to all areas, but hurriedly, rushing to complete an interview in the minimum time possible, they will get the data they want, but questions regarding its validity would be legitimate. On the other hand, a properly conducted mortality survey takes investigators to every part of the area surveyed, gives them a chance to look around and to collect ancillary information, and allows them to paint, in their report, a more nuanced picture than that which can be told only through the numbers.

In my estimation,^{*} the Health and Mortality Survey among Internally Displaced Persons in Gulu, Kitgum and Pader Districts, Northern Uganda, conducted by the World Health Organization with the participation of UNICEF, World Food Program, United Nations Population Fund and the International Rescue Committee in July 2005 is an example of an excellent survey and an excellent report.

Potential limitations presented by investigators

Every survey has its limitations. In the report of this mortality survey, the authors clearly delineate the problems that they encountered and explained how they attempted to deal with them.

First, in any survey that is not a complete census of the population, there are potential “sampling errors”; that is, it is possible that the individuals who are included in the survey will not be representative of the entire population from which they are drawn. The sampling method used for this survey, two-stage cluster sampling, is well recognized and commonly used in mortality surveys – it is not perfect, but it is, at this time, the state of the art.

Nevertheless, in this method, clusters are assigned proportional to the size of the population. In other words, larger IDP camps are more likely to have more clusters sampled within them than are smaller IDP camps. This obviously presupposes that one knows the size of the camps. In N. Uganda, the authors had difficulty establishing exact populations for each camp, and it is possible that the cluster assignment process was somewhat inaccurate. They did, however, use all available information to establish their best estimates of camp populations, and they used information that became available after the survey to validate their results.

In one of the four surveys (Gulu district), almost one-third of the households selected to be interviewed had to be replaced because no one was home at the time of the survey (even after one re-visit) – they were frequently working in their fields. It is hard to know what effect this might have had on the results of the survey, but it is possible that their absence reflected a relatively better security situation which could, in turn, explain the lower (but not low) mortality rates found in this area. On the other hand, it is possible

^{*} I had been consulted on the design and implementation aspects of the survey prior to the survey having been conducted, but not on data issues nor on any interpretation of the results.

that people had to work because they were poorer, a characteristic associated with higher mortality.

Secondly, and perhaps more importantly, all surveys that involve interviews are susceptible to “non-sampling bias”, potential errors that are usually more important. Did the respondents understand the questions? Were there incentives for them to answer in one way rather than in another? Did the interviewers understand the answers correctly? Did they record them accurately?

In this survey, the questionnaire was in English, not in the local language. The interviewers apparently insisted on working from English, over the objections of the principal investigators, because of the many dialects of the Acholi language in which they were working. All interviewers were, however, supervised by native Acholi speakers. Other surveys conducted in the northern Uganda have also used English questionnaires and relied upon the interviewers to translate into the appropriate dialects.

Camp administrators were “almost never warned in advance” of the day on which the interviews were held. There was no opportunity for them to bias the answers of household included in the sample, should they have wanted to do so. In addition, interviewees were told clearly that there would be no compensation for reporting deaths. There is no other obvious reason to suspect that there was any over-reporting of mortality. Finally, a recent rebuttal of the survey results published in the New Vision newspaper in Uganda a few days ago, on April 21, 2006, objected on the basis that “the respondents had to recall how many household members died in the last six months. That is difficult for people who are illiterate and traumatised. Many people in the camps have little notion of time. They don’t remember major events that took place in their lives.” The investigators used a method that was aimed at eliciting the fullest possible recounting of events for the period of recall (January-June 2005). Should people have forgotten about deaths that had occurred, then they would not have been included in the survey and the reported mortality rates lower, not higher, than the actual rates.

As with the design and conduct of the survey, data entry was carefully controlled using double entry techniques and “range checking” and data analysis was done using appropriate computer programs.

In summary, it is unlikely that any important sampling or non-sampling error could have significantly influenced the results in one direction or another.

Other possible errors

In November 2005, the Director-General of Health Services of the Ministry of Health appointed a Technical Review Committee (TRC) composed of representatives of the Ministry of Health, the Institute of Public Health, UNICEF, and the World Health Organization. For the most part, their objections of this Committee to the survey report (which had initially carried the imprimaturs of the Ministry of Health, the World Health Organization, UNICEF, the World Food Programme, the United Nations Population

Fund, and the International Rescue Committee) are either similar to those discussed by the authors of the report (and outlined above) or of limited validity. They emphasize, for example, the high initial non-response rate in Gulu district, but claim that replacement interviews were conducted on the basis of convenience, that they were done with visitors and children, and that the investigators were “driven by the desire just to complete the study on time”. This does not appear to have been the case.

The TRC suggests that the baseline crude mortality rate of 0.46/10,000/day that was used as the basis for calculations of “excess” mortality was too low and that a figure of 1/10,000/day should have been used, thereby lowering significantly the number of “excess” deaths. This objection was echoed recently in a speech by a representative of the Foreign Minister to the UN Security Council. The figure used by the investigators is the appropriate one and the objection is based on a misunderstanding of the difference between a “baseline rate” and the “emergency threshold” discussed above – the threshold level already represents a significant increase of mortality above the baseline, not the baseline level itself.

There are objections to the language used in the interpretation of the results, including comparisons, or lack of them, made to the situation in Darfur. These have no bearing on the sampling methods, on the conduct of the survey, or on the presentation of the results, only on their interpretation. Conservatively put, the mortality rates found in the survey represent a significant increase over appropriately-used baseline rates for both crude mortality and under-five year mortality, and they are considerably above the levels commonly used as thresholds for defining a “public health emergency”. The results are only valid for the population from which the sample used in the survey was drawn (the internally displaced in the three districts and one municipality) and only for the time period in question – January-July 2005.

Results

The principal results of the survey, the mortality rates, are presented below, with mortality rates expressed as deaths per 10,000 population per day:

<u>Area</u>	<u>Crude mortality rates</u>	<u>95% confidence interval</u>
Gulu District	1.22	1.00 - 1.44
Gulu Municipality	1.29	1.04 – 1.53
Kitgum District	1.91	1.45 – 2.37
Pader District	1.86	1.53 – 2.19

Acholi Region total	1.54	1.38 – 1.71

<u>Area</u>	<u>Under-5 year mortality rates</u>	<u>95% confidence interval</u>
Gulu District	2.31	1.76 – 2.86
Gulu Municipality	2.49	1.79 – 3.18
Kitgum District	4.04	3.17 – 4.91
Pader District	4.24	3.40 – 5.08

Acholi Region total	3.18	2.18 – 3.56

These mortality rates are high, exceeding the “emergency threshold” in every case. The overall regional crude mortality rate of 1.5 per 10,000 per day represents, in essence, a near-quadrupling of the baseline mortality rate for Uganda.

Experience in humanitarian emergencies over the past 25 years in all parts of the world has taught that mortality rates in children less than five years old tend to be between 2-3 times higher than those in the general population. Accordingly, the emergency threshold for children has been informally set at 2 deaths per 10,000 children under five years, per day. In Northern Uganda, this threshold is surpassed in each of the four areas surveyed, although in Gulu District and Gulu Municipality, the 95% confidence intervals extend below the threshold. Still, even these lower bounds of the confidence intervals are considerably higher than the baseline under-5 mortality rates (1.14 per 10,000 per day). And in Kitgum and Pader Districts, under-five mortality was exceedingly high.

During the six-month period under study, mortality was fairly constant (approximately equal numbers of deaths were reported to have occurred during each month, except for January, when reported deaths were lower).

In addition to mortality, the investigators also inquired about causes of death. Most conflict-related deaths in a general population have been found to be “indirect” consequences of the conflict itself – that is, they are not deaths due to violence, but rather increases in usual causes of death -- in developing countries, these are usually from relatively common communicable diseases. These increases come about because the insecure environment lowers access to health services – clinics are understaffed and/or under-supplied and not maintained, the population is afraid to travel to the nearest health facility, etc. In Northern Uganda, this is exactly what was found – the leading cause of death in the surveys was malaria, which accounted for nearly one-half of children’s deaths and one-quarter of overall deaths in the survey. Other important causes of death were pneumonia, diarrhea, and a local entity known as “two-langu” of which the clinical

description includes diarrhea as a prominent symptom. Violence accounted for 11% of overall mortality, but less than 1% of mortality in children under 5 years old.

Conclusion

The mortality survey conducted in northern Uganda in July 2005 was technically sound and the results should be accepted. The limitations expressed by the authors of the survey report should be taken into consideration, but there are no objections raised by either the authors or by subsequent reviewers that are likely to have resulted in serious errors to the crude mortality rates or children's mortality rates reported.

The sample was drawn from a population of 1.2 million internally displaced living in four areas of northern Uganda. On the basis of an average daily crude mortality rate of 1.54 per ten thousand per day and an average child mortality rate of 3.18 per 10,000 per day, and their accompanying confidence intervals, one can calculate that between 22-30,000 excess deaths occurred in the displaced population during the first seven months of 2005, of which between 8-12,000 were deaths of children. Deaths rates this high, in a population this large, over an extended period of time, represent a true humanitarian emergency and call for major intervention – if national or local authorities are unable, or unwilling, to respond effectively in an emergency of this magnitude, intervention by the international community is usually indicated.